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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
**RESEARCH AND TECHNOLOGY RESUME**

TITLE

Radar Investigation of Asteroids and Planetary Satellites

PERFORMING ORGANIZATION

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INVESTIGATOR'S NAME

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DESCRIPTION *(a. Brief statement on strategy of investigation; b. Progress and accomplishments of prior year; c. What will be accomplished this year, as well as how and why; and d. Summary bibliography)*

**a. Strategy**: Radar reconnaissance of near-Earth asteroids, mainbelt asteroids, the Galilean satellites, the Martian satellites, and the largest Saturnian satellites, using the Arecibo 13-cm and the Goldstone 3.5-cm systems. Measurements of echo strength, polarization, and delay/Doppler distribution of echo power provide information about dimensions, spin vector, large-scale topography, cm-to-m-scale morphology, and surface bulk density. The observations also yield refined estimates of target orbital elements.

**b. Accomplishments**: Radar signatures have been measured for 31 mainbelt asteroids and 16 near-Earth asteroids since this task began eight years ago. The dispersion in asteroid radar albedoes and circular polarization ratios is extreme, revealing huge differences in surface morphologies, bulk densities, and metal concentration. For the most part, correlation between radar signature and VIS/IR class is not high. Many near-Earth asteroids have extremely irregular, nonconvex shapes, but some have polar silhouettes that appear only slightly noncircular. The signatures of 1627 Ivar, 1986 DA, and the ~180-km mainbelt asteroid 216 Kleopatra suggest bifurcated shapes. Observational milestones during 1987-88 include (i) the first definitive measurement of Io's dual-polarization, 13-cm radar signature; (ii) highly successful, initial radar studies of two near-Earth objects: 1981 Midas at 13.5-cm and the rendezvous-mission candidate 3757 (1982 XB) at 13-cm; (iii) the first 3.5-cm radar detection of Callisto; (iv) the first 13-cm radar observations of the icy Galilean satellites since 1979, with several times the SNR available then; and (v) a series of time-delay-resolved observations of the mainbelt asteroid 654 Zelinda with a" range" precision of 10 km.

**c. Anticipated Accomplishments**: 1) The first radar observations of Phobos and Deimos. 2) Extensive 13-cm and 3.5-cm investigations of all four Galilean satellites during the most favorable Jupiter opposition of the next ten years. 3) High-resolution delay/Doppler imaging of asteroids 1685 Toro, 1580 Betulia, and 1980 PA.

RADAR INVESTIGATION OF ASTEROIDS AND PLANETARY SATELLITES

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**Publications**:

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